

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Daniel T. Colbert et al.  
For: MACROSCOPICALLY MANIPULABLE  
NANOSCALE DEVICES MADE FROM  
NANOTUBE ASSEMBLIES  
Atty Dkt: 11321-P011C1D9

§ Serial No: unassigned  
§ (division of application  
§ Serial No. 10/000,746)  
§  
§ Filed: concurrently herewith  
§  
§ Group Art Unit: 2881 (anticipated)  
§  
§ Prior Examiner: Jack I. Berman  
§ 703.308.4849

U.S. Patent and Trademark Office  
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12/21/01 Wanda Alexander Warren  
Date Signature  
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**PRELIMINARY AMENDMENT ACCOMPANYING REQUEST FOR FILING  
DIVISIONAL APPLICATION UNDER 37 C.F.R. § 1.53(b)**

Sir:

This paper accompanies a Request for Filing Divisional Application Under 37 C.F.R. § 1.53(b) and associated filing fee therefor ("the Request"). If the fee payment is missing or insufficient in amount, or if any other fees are determined to be due, the Assistant Commissioner, Commissioner, and/or the Director of the U.S. Patent & Trademark Office is/are hereby authorized to charge any such fees (or credit any overpayment) to Winstead Sechrest & Minick Deposit Account No. 23-2426, referencing matter number 11321-P011C1D9.

## **AMENDMENTS**

### **In the Title**

Please amend the title by replacing the present title with the following:

--APPARATUS FOR GROWING CONTINUOUS SINGLE-WALL CARBON NANOTUBE  
FIBER--

### **In the Abstract**

Please amend the abstract by replacing the present abstract with the following:

--This invention relates generally to apparatus for growing carbon fiber from single-wall carbon nanotube (SWNT) molecular arrays. The apparatus includes a growth chamber, a heat source, a source of carbon-containing feedstock and a means for maintaining the growing end of the continuous fiber at a growth and annealing temperature where carbon from the carbon-containing feedstock can be added to the growing ends of the individual nanotubes under the direction of a transition metal catalyst. Typically, the apparatus will also have means for continuously collecting the carbon fiber.--

### **In the Specification**

Please amend the specification as noted on page 4, paragraph 11 of the Request by inserting before the first line of the specification the following:

### **--RELATED APPLICATIONS**

This application is a division of co-pending prior application Serial No. 10/000,746, filed on November 30, 2001, which is a continuation of prior application Serial No. 09/242,040 filed on September 13, 1999, which is the 35 U.S.C. § 371 national application of International

Application Number PCT/US97/13896 filed on August 8, 1997, which designated the United States, claiming priority to provisional U.S. patent application Serial Number 60/023,732 filed on August 8, 1996. Each of the foregoing applications is commonly assigned to the assignee of the present invention and is hereby incorporated herein by reference in its entirety.

This application discloses subject matter related to the subject matter of U.S. patent application Serial Number 09/380,545, filed on September 3, 1999 in the name of Richard E. Smalley et al., entitled "Carbon Fibers Formed From Single-Wall Carbon Nanotubes," which application is commonly assigned to the assignee of the present invention and hereby incorporated herein by reference in its entirety.--

#### **In the Claims**

Please amend the claims as follows.

Please cancel claims 1-83 without prejudice or disclaimer to the subject matter thereof.

Please add the following new claims 84-103:

84. (new) An apparatus for growing a continuous carbon fiber comprising:
- a) a growth chamber;
  - b) means for heating a growing end of single-wall carbon nanotubes of an array in the growth chamber, wherein the growing end is heated to a temperature in the range between about 500°C and about 1300°C;
  - c) means for introducing carbon-containing feedstock gas to the growing end to produce a carbon fiber; and
  - d) means for continuously withdrawing a portion of the carbon fiber from the growth chamber.
85. (new) The apparatus of claim 84 further comprising:
- a) means for evaporating a metal to form a vapor; and
  - b) means for depositing the vapor on the array.

86. (new) The apparatus of claim 84 further comprising means for introducing to the array a chemical selected from the group consisting of catalyst precursors, preformed catalyst particles and combinations thereof.
87. (new) The apparatus of claim 84 further comprising a feed lock zone operably coupled to the growth chamber.
88. (new) The apparatus of claim 84 wherein the continuously withdrawing means is a roll.
89. (new) The apparatus of claim 84 wherein:
- a) the heating is applied to a surface of the array; and
  - b) a portion of the surface is in contact with a catalyst.
90. (new) The apparatus of claim 84 wherein the heating is applied to the growing end by a radiation type selected from the group consisting of laser light, radio frequency energy, microwave energy and a combination thereof.
91. (new) The apparatus of claim 84 further comprising an optical pyrometer for monitoring the temperature of the growing end.
92. (new) The apparatus of claim 84 further comprising a means for recycling the feedstock gas from the growth chamber.
93. (new) The apparatus of claim 84 further comprising a means for controlling the temperature of the growing end.
94. (new) An apparatus for growing a continuous carbon fiber comprising:
- a) a growth chamber;
  - b) a heating device, wherein the heating device is operably connected to the growth chamber to heat a growing end of single-wall carbon nanotubes of an array in the growth chamber, wherein the growing end is heated to a temperature in the range between about 500°C and about 1300°C;

- c) a carbon-containing feedstock gas inlet to the growth chamber operably connected to introduce the carbons containing feedstock gas into the growth chamber; and
- d) a transport mechanism device operably coupled to the growth chamber to withdraw a portion of the carbon fiber from the growth chamber.

95. (new) The apparatus of claim 94 further comprising an evaporator operably connected to the growth chamber to evaporate a metal to form a vapor, wherein the vapor is deposited on the array.

96. (new) The apparatus of claim 95 wherein the metal is a portion of a chemical selected from the group consisting of catalyst precursors, preformed catalyst particles and combinations thereof.

97. (new) The apparatus of claim 94 further comprising a feed lock zone operably coupled to the growth chamber.

98. (new) The apparatus of claim 94 wherein the transport mechanism device comprises a roll.

99. (new) The apparatus of claim 94 wherein:

- a) the heating is applied to a surface of the array; and
- b) a portion of the surface is in contact with a catalyst.

100. (new) The apparatus of claim 94 wherein the heating is applied to the growing end by a radiation type selected from the group consisting of laser light, radio frequency energy, microwave energy and a combination thereof.

101. (new) The apparatus of claim 94 further comprising an optical pyrometer for monitoring the temperature of the growing end.

102. (new) The apparatus of claim 94 further comprising recycling piping operably connected to the growth chamber to recycle the feedstock gas.

103. (new) The apparatus of claim 94 further comprising a temperature controller operably connected to the growth chamber.

\* \* \* \* \*

**REMARKS**

1. *Status of the Application.* Claims 1-83 are cancelled herein without prejudice or disclaimer to the subject matter thereof. Claims 84-103 are added herein. No new matter is added by the addition of these claims.

\* \* \* \* \*

It is believed that each of the claims now pending in the present application recites elements neither taught nor suggested by the prior art. Further, it is believed that the application as a whole is in proper form and condition for allowance. If the Examiner believes that the application may be placed in even better condition for allowance, he or she is invited to contact the undersigned at the telephone number noted below. Alternatively, or in addition, if the Examiner believes that an Examiner interview would be beneficial, the Examiner is invited to note that the undersigned has ready access to the videoconferencing facilities of the South Central Intellectual Property Partnership at Rice University in Houston, Texas. The inventors and the undersigned would welcome the opportunity to use those facilities to clarify any issues deemed to remain unresolved.

Respectfully submitted,

Date: 21-DEC-2001

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